Appendix S. Search for Optimum Flux Function to Fit Modeled and Measured Data for Lompoc Applications 3 and 4.



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MEMORANDUM

TO:

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FROM:

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DATE:

December 7, 2001

SUBJECT:

SEARCH FOR OPT MUM FLUX FUNCTION TO FIT MODELED AND

MEASURED DAT ★ FOR LOMPOC APPLICATIONS 3 AND 4

You provided me with model estimates for two contiguous applications of metam sodium. The modeling used an assumed flux of 100ug/m2s. The applications were designated as application 3 and 4, and were at a rate of 56 gallons per acre, drip application to 10 acres each. Table 1 lists the period, length of each period (h), cumulative time (h), sample location designator, two columns of numerical designators, model-estimated values (ug/m3), measured values (including those set to ½ detection or reporting limit).

The idea of this spreadsheet analysis was to assume a flux function of the form

$$y = Ie^{-Rt} \tag{0.1}$$

where y is the flux (g/m2d), I is an initial value (g/m2d), R is the time constant (1/day), and t is time (day). An optimization procedure is then used to adjust the modeled values according to this flux function, while varying the 2 functional parameters to achieve the best fit against the measured data.

As a first step, I determined the application rate in terms of g/m2 of methyl isothiocyanate (MITC). The molecular weight of MITC and metam sodium is 73.1g and 128.17g, respectively. There are 3.18 lbs of metam sodium per gallon. Therefore, using the application rate of 56 gallons per acre, gives the following expression for the g/m2 of MITC that was applied.

$$AR = \frac{56 \frac{gal}{acre} \times 3.18 \frac{lb}{gal} \times \frac{73.1}{128.17} \times 454 \frac{g}{lb}}{4047 \frac{m^2}{acre}} = 11.4 \frac{g}{m^2}$$
(0.2)

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I assumed that half of the MITC volatilized and that most of the volatilization occurred in about 3 days. This leads to rough initial estimates of I=6.4 and R=1.12. These estimates are reasonable with respect to the 50% volatilization assumption because

$$\int_{0}^{\infty} Ie^{-Rt} dt = \frac{I}{-R} e^{-Rt} \Big|_{0}^{\infty} = \frac{6.4}{1.12} = 5.7$$
 (0.3)

For each period from t1 to t2, the average volatilization is $\frac{\frac{I}{R}[e^{-Rt_1}-e^{-Rt_2}]}{t_2-t_1}$, which is in units of

g/m2d. Since the model uses ug/m2s as flux units, it is necessary to convert from g/m2s to ug/m2s. The factor to multiply by is 1e6/(24*3600)=11.57.

The game plan for the spreadsheet is to define a column for the average flux on field 3 and field 4. This average flux will be used in conjunction with the assumed flux of 100 ug/m2s, which was used in the model, to adjust the modeled air concentrations. This adjustment is allowed because of the proportional relationship between flux and concentration. Since both fields were the same size, and applied with the same rate, and were contiguous, and since the receptors are located at some distance from the field, I effectively used the same field for both applications. I do not expect that explicitly modeling the second field would make any appreciable difference since the locations were nearly the same.

After adjusting the model estimated air concentrations, then the squared differences between the modeled and measured values are summed and this sum is the object of minimization, using the 'Solver' feature in Excel (2000). I and R are the parameters to vary in this procedure.

The spreadsheet shows the average flux from field 1 and field 2 (in units of g/m2h because I used the hours in the denominator since that is how the information was originally provided). These fluxes are summed and converted to ug/m2s and used to adjust the modeled values. For each time period there are 5 measurements. Within each time period, the adjustment is the same and utilizes the parameters I and R in the upper left of the spreadsheet (at locations D1 and D2).

I tried optimizing with respect to the sum of squares of individual measurements and also with respect to the sum of squares of period average measurements. I also tried setting the 'artificial' measured values, which were derived by setting non-detects equal to ½ of the detection limit and trace values as ½ of the reporting limit, to zero. I will only report here on the scenario, which used the period average values and included the artificial measured values. The other three scenarios (individual values, setting and not setting artificial values to 0, average period values setting artificial values to 0) gave similar results.

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Results

The results in terms of the derived flux function are not reasonable. The optimization gave values of I=24734g/m2 and R=17.848. This does not make sense physically since it implies an extremely high flux in the first few minutes of application, quickly descending to practically 0 (Figure 1). More importantly, it implies that 1390 g/m2 (=24374/17.8) of MITC volatilized, which far exceeds the applied amount of 11.4g/m2.

Figure 2 compares the modeled and measured period averages, both for the optimized function and for the 'reasonable' function, which used values of I=6.4 and R=1.12. Figure 2A shows the time course of average period measured values, where the non-detects are estimated at half the detection limit, and trace reports are estimated at half the reporting limit. Also plotted are the time course of modeled values, using the optimized parameters of I=24734 and R=17.848, and modeled values using the 'reasonable' flux function consisting of I=6.4 and R=1.12. The reasonable flux function generally overestimates measured values with one very high overestimate at about 35 hours. The optimized flux function performs better, tracking the measured values fairly well (Figure 2A). When the measured values are used as the x-axis and the modeled values as the y-axis, the previous generalization is clearer (Figure 2B). The optimized function plot in Figure 2B is dominated by a single high point, while the remaining points cluster near low values. The reasonable function has a looser cluster of points at low values, but two very widely spread points, one near (0.02, 0.5), and the other near (0.14, 0.07). The latter point for the optimized function corresponds to (0.14,0.12).

Conclusion

It is possible that a different function would have performed better. A logical choice would be a function, which starts at 0, reaches a peak, and then diminishes. For example, the lognormal function behaves this way. However, at this time, I do not know how to quickly get Excel to integrate a lognormal function, because no analytic solution exists for the integral. Another possibility is that the use of positive values for non-detects and traces may throw off the fitting exercise. However, though I did not report the results here, when I set the non-detects and traces to zero, the results were similar to the case reported on in this memorandum. Another possible explanation is that the gaussian model does not properly account for air dispersion in the Lompoc Valley. A final possibility is that other sources of MITC occurred during the monitoring process besides those which were included in the model.

An appendix to this memorandum contains the formulas used in these calculations.

Attachments

cc: Dr. Kean S. Goh, Agricultural Program Supervisor IV (w/Attachments)

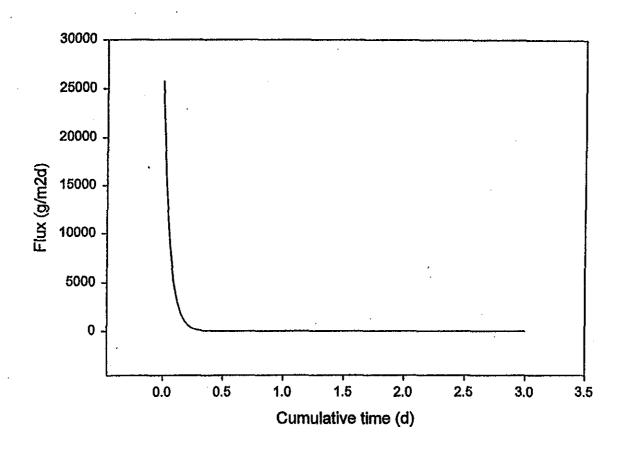


Figure 1. Flux function when period averages optimized and artificial values used. Parameters are I=24375 and R=17.8.

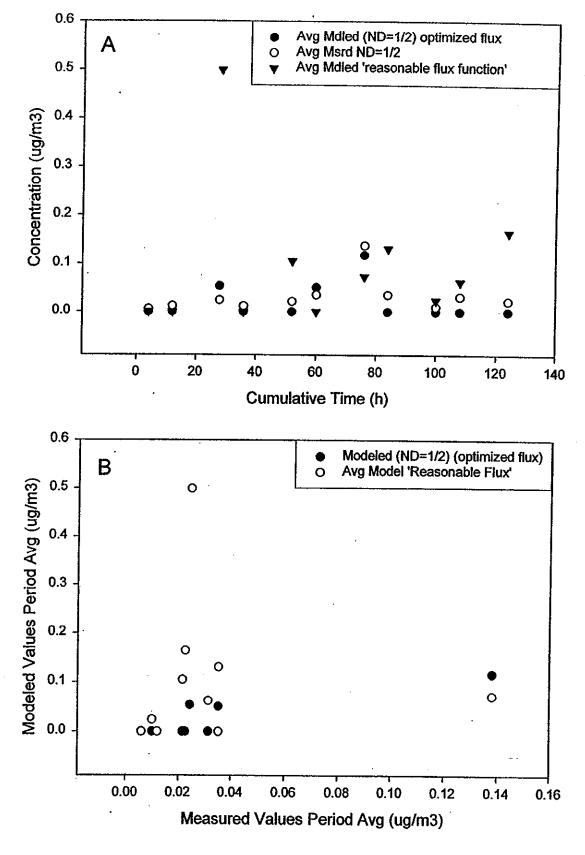


Figure 2. Modeled and measured values compared over time (a). Modeled values compared to measured (b). 'Reasonable flux' function had parameters of I=6.4 and R=-1.12.

Table 1. Simulated modeling calculations to find an optimum flux function of the form y=lexp(Rt)

		l R	24734.68 -17.8448				g/m2h field 1	field 2	ug/m2s fld1+fld2			0.311959904	0.3134	avg model	avg msrd	0.005148 SSQ
This	This uses the average values for each period and uses the half detection limit estimates 1b application only (4hrs)															
1	4		NW		3838191	0	328.8234	٥	91314.25	Đ	0.006	0.000036 * 0		0	0.006	0.000036
'	7	٦	NE		3836118		328.8234	-	91314.25		0.006	0.000036 * 0		-	0.000	2.00000
			W	731386	3836540		326.8234		91314.25		0.006	0.000036 * 0	-			
			C	733174	3835789		328.8234				0,006	0.000036 * 0				
			sw	731392	3835146		328.6234	ō			0.006	0.000036 * 0				
2	8	12	. NW	731353			8.829265	-	2451.887		0.012	0.000144 * 0		0	0.012	0.000144
-	۳	••	NE	733785			6,829265	ō			0.012	0.000144 * 0		_	0.012	0.000144
			W	731386	3836540		8.829265	_	2451.887	_	0.012	0,000144 * 0				
			Ċ	733174			8.829265	ō			0.012	0.000144 * 0				
			SW	731392		0	8.829265	0	2451.887	Đ	0.012	0.000144 * 0	0			
3	16	28	NW	731353	3838191		0.011554	0	3.206522	1.51E-05	0.047	0.002207583 1	4.81E-06	0.0537612	0.0244	0.000862
, •			NE	733785	3638118	0	0.011554	0	3.208522	0	0.012	0.000144 * 0	0			
			W	731386	3836540	6,56323	0.011654	0	3.208522	0.210583	0.039	0.029440625 1	0.032812			
			Ċ	733174	3835789	1.81418	0.011554	0	3.208522	0.058208	0.012	0.002135214 * 0	0.003388			
			8W	731392	3835146	0	0.011554	0	3.206522	0	0.012	0.000144 * 0	0			
4	8	36	NW	731353	3838191	0	1.57E-07	0	4.36E-05	0	0.012	0.000144 * 0	0	0	0.012	0.000144
•	٠	-	NE	733785	3838118	0	1.57E-07	0	4.36E-05	0	0.012	0.000144 * 0	0			
			W	731386	3836540	0	1.57E-07	0	4.36E-05	0	0.012	0.000144 * 0	0			
			Ċ	733174		0	1.57E-07	0	4.36E-05	0	0.012	0.000144 * 0	0			
			SW	731392	3835146	0	1.57E-07	ø	4.36E-05	0	0.012	0.000144 * 0	0			
5	16	52	NW	731353			2.06E-10	0	5.71E-08	3.09E-09	0,006	3.6E-05 * 0	9.53E-18	6.176E-10	0.0216	0.000467
•	10	·	NE	733765	3838118		2.06E-10		5.71E-08		0.006	0.000036 * 0	0			
			W	731386	3836540	_	2.06E-10	ō	5.71E-08	0	0.064	0.007056 1	4.98E-05			
			č	733174	3835789		2.06E-10		5.71E-08	0	0.006	0.000036 * 0	0			
			SW	731392	3835146		2.06E-10	0	5.71E-08	0	0.006	0.000036 * 0	0			
6	- 8	60	NW	731353	2836191	0.00053	2.79E-15	172.8118	47989.83	0.254346	0.051	0.041349635 * 0	0.064692	0.0508692	0.0354	0.000239
	٠	90	NE	733785	3838118	0		172,8118	47989.83	0	0.051	0.002601 * 0	0			
			w	731386	3836540				47969.83	0	0.051	0.002601 * 0	0			
			Ċ	733174	3835769	ō		172.8118		0	0.012	0.000144 * 0	0			
			sw	731392	3835146	ō		172.8118		0	0.012	0.000144 * 0	0			
7	16	76		731353	3838191	0.8985	3.66E-18		62.79916	0.56425	0.23	0.111723382 1	0.204781	0.118188	0.1382	0.0004
•		. •	NE	733765	3838118		3,66E-18		62,79916	0.025773	0.069	0.001868593 1	0,000571			
			W	731386	3836540		3.66E-18	0.22614	62.79916	0	0.29	0.0841 1	0.007073			
			Ċ	733174	3835789	. 0	3.66E-18	0.22614	62,79916	0	0.026	0.000676 * 0	0			
			SW	731392	3835146	0.00146	3.66E-16	0.22614	62.79916	0.000917	0.076	0,005637477 1	2.23E-05			
B	В	84	NW	731353	3838191	0	4.97E-23	3.07E-06	0.000854	0	0.012	0.000144 * 0	0	5.106E-06	0.0354	0.001253
-	_		NE	733785	3836118	0	4.97E-23	3.07E-06	0.000854	0	0.012	0.000144 * 0	0			
			W	731386	3836540	1.98199	4.97E-23	3,07E-06	0.000854	1.69E-05	0.051	0.002599275 * 0				
			C 1	733174	3835789		4.97E-23		0.000854			0.002600217 * 0	5.89E-11			
			SW	731392	3835146	0.10951	4.97E-23	3.07E-06	0.000854	9.35E-07	0.051	0.002600905 * 0				
9	16	100	NW	731353	3838191	0.00563	6.5E-26	4.02E-09	1.12E-06			3.6E-05 * 0		2.116E-09	0.01	1E-04
			NE .	733785	3838118	0		4.02E-09		_	0.006	0.000036 * 0	0			
			W	731386	3836540	0		4.02E-09		-	0.026	0.000676 * 0	0			
			C	733174	3835769	0		4.02E-09			0.006	0.000036 * 0	0			
			SW	731392	3835146	0.94173			1.12E-08			3.59999E-05 * 0				
. 10	8	108	NW	731353	3838191	0		5.47E-14			0.051	0.002601 * 0	0	1.328E-13	0.0315	0,000992
			NE	733765	3838118	0		5.47E-14			0,012	0.000144 * 0	Đ			
			W	731386	3836540			5.47E-14		4.5E-13		0.002601 * 0				
			C	733174	3835789				1.52E-11				5.37E-27			
			SW	731392	3835146	0.5349	8.84E-31	5.47E-14	1.62E-11	8.12E-14	0,012	0.000144 * 0				. (
11	16	124	NW	731353	3838191				1.99E-14			3.6E-05 * 0		7.874E-16	0.0226	0,000511
• •			NE	733765	3838118	0.00074	1.16E-33	7.15E-17	1.99E-14			0.000676 * 0				
			W	731386	3836540	1.2083			1.99E-14	2.4E-16			5.76E-06			
			Ċ	733174	3835789	1.27315	1.16E-33	7.15E-17	1.99E-14	2.53E-16	0,026	0.000676 * 0	6.4E-32			
			SW	731392	3835146	16.93565	1.16E-33	7.15E-17	1.99E-14	3,36E-15	0.006	3.6E-05 * 0	1.13E-29			
			,	· -												

		1	₹	6.4 g/m2 -1.12 1/d			g/m2h field 1	field 2	ug/m2s fld1+fld2			5.054938251	4.437141	avg model	avg msrd	0.268938 SSQ
This	This uses the average values for each period and uses the half detection limit estimates 1b application only (4hrs)															
1		4	4 NW		3838191	0	0.243257		67.5524		0.006	0,000036 * 0) 0	. 0	0.008	0.000036
•		4	NE	733785			0.243257				0.006			•	0.000	0.000056
			w	731386			0.243257				0.006					
			Ċ	733174			0.243257				0.006					
			sw	731392	-		0.243257	Ō		_	0.006		_			
2		8	12 NW	731353			0.184651	-	51.27754	-	0.012		-	. 0	0.012	0.000144
-		•	NE	733785	-		0.184651		51,27754	_	0.012		_	•	0.012	0.000144
			W	731386		-	0.184651		51.27754		0.012	0.000144 * 0	-			
			Ċ	733174			0.184651		51.27754		0.012					
			SW		3835146		0.184651		51.27754		0.012	0.000144 * 0				
3	1	6	28 NW	731353			0.107317		29,80198					0.4993548	0.0244	0.225582
•	•		NE	733785			0.107317	Ó	29,80198		0.012	0.000144 * 0		•		
			w	731386		6.56323	0.107317	0	29.80198	1.955973	0.039		2.954312			
			Ĉ	733174		1.81418	0.107317			0.540662						
			SW	731392		0	0.107317		29.80198		0.012	0.000144 * 0				
4		8	36 NW		3838191	0	0.060248	0	16.73083	0	0.012	0.000144 * 0		0	0.012	0.000144
			NE	733785		0	0.060248	0	16.73063	0	0.012	0.000144 * 0	0			
			W	731386	3836540	. 0	0.060248	0	16,73083	0	0.012	0.000144 * 0	0			
			C	733174	3835789	0	0.060248	0	16,73083	0	0.012	0.000144 * 0	0			
			SW	731392	3835146	0	0.060248	0	16.73063	0	0.012	0.000144 * 0	0			
5	1	6	52 NW	731353		5.41019	0.035015	0	9.723784	0.526075	0.006	0.270478219 * 0	0.276755	0.105215	0.0216	0.006991
_	•	-	NE	733785		0	0.035015	0	9.723784	0	0.006	0.000036 * 0	0			
			W	731386		. 0	0.035015	0	9.723784	0	0.084	0.007056 1	4.98E-05			
			Ċ		3835789	0	0.035015	0	9.723764	Û	0.006	0.000036 * 0	Q			
			SW	731392	3835146	0	0.035015	0	9.723784	0	0.006	0.000036 * 0	0			
6	-	8	60 NW	731353	3838191	0.00053	0.019658	0.222546	67.25993	0.000356	0.051	0.002564766 * 0	1.27E-07	7.13E-05	0.0354	0,001248
-		-	NE	733785			0.019658				0.051	0.002601 * 0				
			W	731386			0.019658				0.051	0.002601 * 0	O			
			Ċ	733174		0	0.019658	0.222546	67,25993	Ō	0.012	0.000144 * 0	. 0			
			SW	731392	3835146	0	0.019658	0.222546	67.25993	Ô	0.012	0.000144 * 0	Ö			
7	16	6	76 NW	731353	3838191	0.8985	0.011425	0.129341	39.09078	0.351231	0.23	0.014696875 1	0.113255	0,0735689	0.1382	0.004177
			NE	733785	3838118	0.04104	0.011425	0.129341	39.09078	0.016043	0.069	0.002804459 1	0.000175			•
			W	731386	3836540	0	0.011425	0.129341	39.09078	0	0.29	0.0841 1	0.007073			
			С	733174	3835789	0	0.011425	0.129341	39.09078	0	0.026	0.000676 * 0	0			
			SW	731392	3835146	0.00146	0.011425	0.129341	39.09078	0.000571	0.076	0.005689575 1	2.62E-05			
8	1	8	84 NW	731353	3838191	0	0.006414	0.072612	21.94556	0	0.012	0.000144 * 0	0	0.1312709	0.0354	0.009191
			NE	733785	3838118	0	0.006414	0.072612	21.94556	0	0.012	0.000144 * 0	0			
			W	731386	3836540	1.98199	0.006414	0.072612	21.94556	0.434959	0.051	0.147424314 * 0	0.189189			
			C	733174	3835789	0.89933	0.006414	0.072612	21.94556	0.197363	0.051	0.02142212 * 0	0.038952			
			SW	731392	3835146							0.000727242 * 0				
9	10	6 1	WN 001	731353	3838191	0.00563	0.003728	0.042201	12.75453	0.000718	0.006	2.78987E-05 * 0	5.16E-07	0.0241663	0.01	0.000201
			NE	733765			0.003728			_	0.006	0.000036 * 0	0			
			W	731386	3836540		0.003728			_	0.026	0.000676 * 0	. 0			
			C	733174	3835789		0.003728				0.006	0.000036 * 0	0			
			SW	731392	3835146							0.013021835 * 0	0.014427			
10	1	8 1	WK 80	731353	3838191		0.002093				0.051	0.002601 * 0	0	0.0626309	0.0315	0.000969
			NE	733785	3838118		0.002093				0.012	0.000144 * 0	0			
			W	731386	3836540							0.025992712 * 0	0.045038			
			C	733174	3835789		0.002093						0.001194			
			SW	731392	3835146							0.000691739 * 0				
11	10	6 1	24 NW	731353	3838191							0.000110322 * 0	0.000272	0.1649172	0.0226	0.020254
			NE	733785	3838118	0.00074	0.001216	0.013769	4.161546	3,08E-05	0.026	0.0006744 * 0	9.48E-10			
			W	731386	3836540		0.001216					1.64856E-06 1	0.002528			
			C	733174	3835789		0.001216					0.000728067 * 0				
			SW	731392	3835146	16.93565	0.001216	0.013769	4.161546	0.704765	0.006	0.488300313 * 0	0.496722			

Appendix 1. Spreadsheet formulas used to calculate flux from negative exponential function and adjust modeled air concentrations accordingly.

			•									
	5,0 g/m2	g/m2h		ught2s			=\$UM(RM:M89)		-8LHA(P8:P80)			=5UM(65:659)
r -17.8-	u 1H	Seld 1	tid:2	Bd1+Bd2						wyg model	avg mert	
Th 1bs					This uses the everag							
1 4 4 NW	731353 36361B1 0	=(-\$D\$1/5D\$2)*(1-EXP(\$D\$2*3C\$5/24))/\$385	0	=(145+45)*277.7	=(35/1007*36	0.006	=(105-1.5)*2		=(105-145*05)*2	=AVERAGE(R5:KB)	=AVERAGE(LS:L9)	≠(Q5-R5)*2
NE:	733785 3636116 0	-4011003271-EXF(3032303524))1835	0	=(H5+I6)*277.7	=(38/100)*G6	0.006	-(198-L6)*2	• 0		·		-(40-10) &
w	731306 3636540 0	=(-\$D\$1/5D\$Z)*(1-EXP(\$D\$Z*\$C\$6/24))/\$8\$5	D	-(\(1'+17)*277.7	=(J7/100)*G7	0.000	=(107-127)*2		=07-47"07)*2			
C	733174 3635769 0	=(4031/3032)71-EXP(3032-3035/24))9835	0	=(H5+H5)*277.7	=(J87100)*G6	0.008	=(K6-U8) *2	• 5	=(154606) 72			
8W	731392 3635146 0	=(-\$0\$1\\$DEX)^[1-EXP(\$DEX*\$CBEI24))/\$885	0	=(1 10 +le)*277.7	(J01100)**00	0.008	=(103-(19)*2		*(103-1459*05)*2			
28 12 NW	731353 3636191 O	(\$D\$1/\$D\$2)*((EXP(\$D\$2*\$C\$524)-EXP(\$D\$2*\$C\$10724))/\$B\$10)	0 .	=(110+10)*277.7	=(310/100) *G10	0.012	=(K10-L10)*2	* 10	- =(K10-M10*O10)*2	=AVERAGE(K10;K14)	=AVERAGE(L10:L14)	=(Q10-R10)*2
NE	733785 3636118 D	 (\$0\$16062)*((EXP(\$0\$2*3C6924)-EXP(\$0\$2*\$C\$10(24))/\$8\$10) 	0	=(111+111)*277. 7	=(#11700)*G11	0.012	=(K11-1,11)*2	. 0	=(K11-M11*011)*2			
₩	731396 3636540 0	 (\$D\$18D\$2]*((EXP(\$D\$2*\$C\$324)-EXP(\$D\$2*\$C\$10(24))/\$8\$\$10) 	0	=(112412)*277,7	-(J12/100)*G12	0.012	=(K12-L12)*2		=(K12-M12*O12)*2			
c	733174 3635789 D	-(SD\$1/SD\$2)*((E/P*(\$D\$2*\$C\$826)-E/P*(\$D\$2*3C\$10(24))/\$8\$10)	0	=(H15H13)*277.7	-(J13/100)*G13	0.012	*(KI3-L13)*2	. 0				
SW	731392 3630140 D	 (\$0\$1/\$0\$2)*((E0*(\$0\$2*\$C\$52*4)-EX*(\$0\$2*\$C\$10(2*4))*\$8\$10) 	0	=(114414)*277.7	=(314/100)*G14	0.012	-(K14-L14)/2	. 0	-[RI44H14-016)45		•	
3 16 28 1977		C7 - (\$D\$1/BD\$2)*((ECP(\$D\$2*\$C\$10034)-ECP(\$D\$2*\$C\$1803-0)/18815)	0	=(115416)*277.7	=(315/100)*G15	0.047	=(K15-L15)*2	. 1	=(KTS-M15*Q15)*2	-AVERAGE(KIS:KIB)	=AVERAGE(L15:L19)	-(Q15-R15)*2
NE	733785 3636116 0	=-(\$D\$1/\$D\$2)*((EOP(\$D\$2*3C\$10/24)-EOP(\$D\$2*3C\$16/24))*(88\$15)		=(H10+H6)*277.7	-(191100)-014	0.012	=1016-L16)*2	• 0				
w		23 (3031/3032)*((EPP(30323031024)-EPP(303230318934))(88318)	•	=(11174177)*277.7	=(J177100)*0:17	0.010	-(KIT-LTT)*2	. 1	₹₹₹₹₹₹			
C EW		16 -(SD\$1/SD\$2/((EXP(SD\$2*C\$10/2-()-EXP(SD\$2*3C\$16/2-())/98\$15)	•	=(H18+H18)*277.7	-(J12/100)*018	0.012	=(1016-1.18)*2		#			•
4 R 38 NW	731382 3635146 0 731353 3636191 0	=-(3031/3042)*((E)P(3032*\$C31024)-E)P(3032*\$C31924)/36315) =-(3031/3042)*((E)P(3032*\$C31624)-E)P(3032*\$C31024)/36330)	^	*(H10*H10)*277.7 *(H20*H20)*277.7	=(319/100)*G20	0.012	=(1038-L18)*2 =(1028-L28)*2	: 0	-(K16-M19*019)*2			
4 6 36 644	731303 30301V(U	=(\$D11/\$D627(\$D9(\$D42*\$C11624)-\$DP(\$D42*\$C42024))/\$6820)	n	~(H2(+I2()*2/7.7	-(321/100)*020	0.012	-1024-L213-2	. 0	(· · · · · · · · · ·	=AVERAGE(ICOXCX)	=AVERAGE(L20:L24)	=(030-630), 3
w	731386 3636540 0	=(\$D\$1/8D\$2)*((EXP(\$D\$2*\$C\$1924)-EXP(\$D\$2*\$C\$20034))*88\$20)	t t	=(H22+H22)*277.7	=(12210071322	0.012	=(1023-1,22)*2		from more analysis			
Ë	733174 3635769 0	-(\$1516042)*((EP(\$0423031524)-EP(\$01230320))#5120)	o c	=(423+23)*277.7	=(323/100)*0223	0.012	=00342372		(
SW	731362 3636146 O	=(1D\$1/1D\$2]*((EX*(3D\$2*\$C\$1924)-EX*(3D\$2*\$C\$2024))V\$8\$20)	0	o(1124+124)*277.7	-(324/1007/324	0.012	-((24-1,24)*2		=(1/24-1/24-024)-2			
5 18 52 NW	731353 3636181 6,410	HS =(\$DH/\$D\$27((EP\$\$D\$23C120724)-EP\$\$D\$23C1274724)(\$B\$225)	0	=(1426+(25)*277.7	-(325/100)*0015	0.008	-(KZ5-L25)*2			=AVERAGE(K25;K29)	*AVERAGE(L25129)	<(Q25-R25)*2
NE	733765 3636118 0	=(\$D\$1/5D\$27((D0*(\$D\$2*\$C\$20/24)-D0*(\$D\$2*\$C\$25/24))/\$\$\$25)	0	=(120+126)*277.7	=(J281100)14226	0.008	-(126-126) 2		=(K28-M28-O28)*2			4423423)72
w	731366 3636540 O	-(\$D\$1/\$D\$21'((EXP(\$D\$2*3C\$2024)-EXP(\$D\$2*\$C\$25/24))#8\$25)	0	=(HZ?+IZIYZIT.7	=(.127/100)*0327	0.084	-027-127/2	•	=(KZ7-MZ7*OZ7)*2			
c	733174 3635769 O	=(\$0\$1/30\$2)^((EXP(\$0\$2*\$C\$2024)-EXP(\$0\$2*\$C\$2504))(\$8\$25)	0	-(1426+126)*277.7	=(J28/190)*G28	0.006	4(128-125)*2	- 6				
sw	731302 3035146 0	-(\$D\$1/8D\$2)*((EX*(\$D\$2*9C\$20/24)-EX*(\$D\$2*9C\$25/24))788\$25)	C	-(129128)*277. 7	=(329/1007/329	0.008	-(1039-123)/2	- 0	_=(N28-M29*029)*2			
6 8 60 NW	731353 3636101 0.000		-(IDENIDES) ((Edi(IDES/ICES-GS)/S4)-Edi(IDES/ICES0-GS)/S4)(IBESO)	=(HSO+RSO)*277.7	<(1301:00)*G30	0.051	=(130(30)*2	• •	=(1000-M30*030)*2	=AVERAGE(IGOSIGN)	=AVERAGE(L30:L34)	=(030-R30)*2
NE	733785 3836118 0	-(\$D\$1/BD\$2/Y(EXP(\$D\$2*\$C\$25/24)-EXP(\$D\$2*\$C\$30/24))/\$B\$30)	-(\$D\$1/\$D\$2)*((EDP(\$D\$2*(\$C\$26-62)/24)-EXP(\$D\$2*(\$C\$30-62)/24))/\$B\$30)	=(H31+H31)*277.7	=(331/100)*331	0.051	4131-13172	• •			, ,	• • • • • •
₩	731386 3636540 0	 (1011/1015)-((Ex.(1015.301529)-Ex.(1015.30134))48120) 	-(10474045).4(E-0.(1045.42045-45).54)-E-0.(1045.42045).4(1045.4)	=(1024027277.7	-(#32/100)*632	0.051	-41625-1251.5		(IC25-M35-035)-5			
c	733174 3635789 0	=-(\$D\$1\\$D\$2\f(EXP(\$D\$2\\$C\$2824)-EXP(\$D\$2\\$C\$3024))45\$30)	→(\$081/\$082)*((E-0*(\$082*(\$082*62)24)-E-0*(\$082*(\$082*(\$082*(24))\$8889))	=(133+133)*277. 7	-(1231,00),032	0.012	-(103-L33) *2		+(1033-40331033)12			
8W	731392 3835146 D	-(1011/1012)*((EP(1012*3C12624)-EP(1012*3C13074))38130)	-(sourcest/(Eq.(coss.fscess-es)s-6-Eq.(sous.fsceso-es/s-e))asseo)	=(1134+134)*277.7	=(.034/100)*034	0.012	-104-130/2		(
7 18 76 NW	731353 3636181 Q.606 733765 3636116 Q.041		 (10\$18062)((00\$(50\$2)60830-62)24)-609(\$0\$2)(\$0\$36-62)24)(\$98336) (10\$18062)((00\$(50\$2)60830-62)24)-609(\$0\$2)(\$0\$25-62)24)(\$98336) 	=(H36+I38)*Z77.7	-(235*(00)*235	0.23	=(R35-L35)*2	1	-(135-M35*135)*2	=AVERAGE(RGS:K30)	=AVERAGE(L35:L39)	=(035-R35)*2
NI;	733700 3030116 UJUN 721300 3030540 O	04 = (\$0\$1,0012)*((EXP(\$0\$2*3C\$3024)-EXP(\$0\$2*3C\$3524())*\$\$\$\$)	=(E081/8085),((E0618085,(2080-65554)-E06(8085,(2088-65554))88889)	=(1:06+0:6)*277.7	=(1361,00),636	0.000	=(136-136)*2	3				
77	733174 2635769 0	-(\$D\$1/\$D\$2"((E)P(\$D\$2"\$C\$9D2()-E)P(\$D\$2"\$C\$9D2()/\$B\$35) -(\$D\$1/\$D\$2"((E)P(\$D\$2"\$C\$9D2()-E)P(\$D\$2"\$C\$9D2()/\$B\$35)	-(\$0\$148042]*((\$0\$P\$27\\$C\$30-62)-\$0\$(\$0\$27\$C\$36-62)(24))\$8\$38)	=(H374I37)*277.7 =(H384I38)*277.7	=(J37/100)*G37	0.25	*(1037-L37)*2	. 1				
EW.		** -(\$D\$1(\$D\$2)(EXP(\$D\$2*\$C\$3024)-EXP(\$D\$2*\$C\$35/24))(\$\$\$\$5)	-(501/3042)((E09(50427(C530-62)24)-E09(50427((C546-62)24))(48135)	=(100+100)*277,7	=(J301100)*G36 =(J301100)*G30	0.076	=(100-L36)*2 =(100-L36)*2	• 5	=(108-408-038)*2			
8 8 84 NW	731353 3636191 0	=(10110012)"((EXP(1012*10136/24)-EXP(1012*10140/34))/10140)	-(8D\$14D\$2)*((EXP(8D\$2*(\$C\$35-62)/24)-EXP(\$C\$2*(\$C\$40-62)/24))\$55\$40)	=(140+140)*277.7	-(340°100)*G40	0.012	=(K40-L40)*2		=(K40-M40*038)*2	WAVERAGE(K40;K44)		
NE NE	733785 3636116 0	=(\$0\$1/\$D\$2*((E)P(\$D\$2*\$C\$5524)-E)P(\$D\$2*\$C\$40Q4))/\$8\$40)	-(3D\$1/3D\$2*(TEXP\$3D\$2*\$\$C\$35-62)(24)-EXP\$3D\$2*(\$C\$40-62)(20)(\$E\$40)	=(1414441)*277.7	-C341/1007/G41	0.012	=(K41-L41)*2			MAERONE (MICHAE)	=AVERAGE(L40:L44)	=(040-R40)*2
w	731365 3636540 1,981	99 ~(\$D\$1/\$D\$2]*([EXP(\$D\$2*\$C\$36(24)-EXP(\$D\$2*\$C\$40(24))/\$B\$40)	-(\$D\$1(\$D\$2)*([DOP(\$D\$2*(\$C\$35-52)26)-EXP(\$D\$2*(\$C\$40-52)26))\$5540)	=(H42+422*277.7	-(J42/100)*G42	0.061	=(K42-L42)*2		4			
c		DS =(\$D\$1/\$D\$2)*((EXP(\$D\$2*3C\$9524)-EXP(\$D\$2*3C\$40(24))/\$B\$40)	=(XD\$1/XD\$2)*((EXP(XD\$2*(3C\$36-62)/24)-EXP(XD\$2*(\$C\$40-62)/24))(86\$40)	=(H43H43)*Z77.7	=(349/100)*045	0.051	=(K43-L43)*2		-KGNGOGY2			
sw.	731302 3635146 0.10	IS1 = (\$D\$1/BD\$27((EXP(\$D\$27\$C\$9624)-EXP(\$D\$27\$C\$4024())(\$B\$40)	=(1081/1082/1(EXP(1082/(10136-62)/24)-EXP(1012/(1012/(10140-62)/24))(18840)	=(H44+H44)*277.7	=(J447100)*Q44	0.00%	-1044.40 *2					
9 16 100 MW	731953 3636191 0.005	HES - (\$D\$1/8D\$Z *((EXP(8D\$Z*(\$C\$40)/24)-EXP(8D\$Z*(\$C\$46)/24))/\$B\$46)	=(\$D\$1/\$D\$27((DCP(\$D\$2Y\$C\$40-62)/24)-EXP(\$D\$2Y\$C\$45-62)(24))(\$B\$45)	=(H45+H45)*277.7	=£467100)*G46	0,005	=R45-L45/12		************	#AVERAGE(K45;K49)	=AVERAGE(L45(L49)	WITH RASKS
NĚ	733766 3636116 0	=(\$D\$\\\$D\$2 ^(ED\$(\$D\$2^\\$C\$40)(\$4)-EXP(\$D\$2^\\$C\$46)(\$4))\$B\$46)	=(E081/E082/(E092/SCE40-62)(26)-E07(E082/SCE46-62)(24)(E082/SCE46-62)	=(H40H46)*277.7	=(348/100)*346	0.008	=(K46-L46)/2					-(eco-temp) E
w	731386 3638540 0	(SD\$1/SD\$2)*((EXP(SD\$2*(SC\$40)X24)-EXP(SD\$2*(SC\$40)X24))/88\$46)	=-(\$D\$1/BD\$2)*((EDP(\$D\$2*(\$C\$40-62)/24)-EXP(\$D\$2*(\$C\$46-62)/24))\$6846)	=(H47+I47)*277.7	-(M7/100)*G4T	0.026	- (K47-L47)*2	٠ ,	-(KG-MG*OG)/2			
C	733174 3635789 O	-(1011/1013)*((E0*(1013*(10140)O/)-E0*(1013*(10146)O/)/18146)	-(soireotal/(exploration-oration)-exploratacter-exity()ississ)	=(145+146)*227,1	-(#401190)*340	0.006	=(1648-1,46)*2	* (=(K48-848-D48)-3			
8W		73 ~(\$D\$1/\$D\$2)^(EXP(\$D\$2'(\$C\$40)(24)-EXP(\$D\$2'(\$C\$40)(24))/\$8\$40)	-(SD\$1/3D\$2)*([EDP(\$D\$2*[\$C\$40-62)24)-EOP(\$0\$2*(\$C\$45-62)24))\$88\$45)	=(140+140)*277.7	-(346/100)-G40	900,0	≠(K49-L48)*2	٠,	-(K#HM#7049 /2			
105 106 NW	731353 3636191 0	=-(\$061/\$052)*((E0*(\$052*(\$0545)24)-EXP(\$012*(\$0360)24))#\$990)	-(1041/1015/(104/1015/1014-05/04)-EA(1015/10150-05/04))48880)	=(150+150)*217.7	=(350/100)*050	0.051	=0.0001720).43		=(100)-1150*050)*2	-(1000405144324454)4	#(L50+L51+L52+L54)A	(=(050-R50)*2
ME MA	733785 3636116 0	=(1011/3042)*((E0*(1012*(3014*)/24)-E0*(3012*(3030*)/24))/38350)	*(\$0\$1,50\$2)*((\$0\$2*(\$0\$2*(\$0\$45-62);24)-50*(\$0\$2*(\$0\$40-62);24))(\$\$\$(\$0\$	*(151+151)*277.7	=(JS1/100)*GS1	0.012	=(1051-L51)*2	٠,				
w		84 ={\$D\$1/\$D\$2/*((EXP{\$D\$2*{\$C\$45}/24}-EXP{\$D\$2*(\$C\$60)/24)/\$8\$60) 26 ={\$D\$1/\$D\$2/*((EXP{\$D\$2*{\$C\$45}/24)-EXP{\$D\$2*(\$C\$60)/24)/\$8\$60)	-(\$091/\$0127((\$04(\$0127(\$046-62)24)-\$)(#(\$0127(\$050-62)24))#####) -(\$061/\$0127((\$0427(\$046-62)24)-\$)(#\$0127(\$040-62)24)#####)	=(\fi2+ti2)^2/7.7	=(362/100)*G62	0.051	=(4625-185)5					
sw.	731382 3635146 0.534		-(\$D\$1/\$D\$2]/((DPC(\$D\$2/\$C\$4-62)/24)-EVC(\$D\$2/\$C\$5D42)/24)/\$\$\$\$()	=(153+53)*277.7 =(154+554)*277.7	=(353/100)*G63	foot			=(NSS-NESS*OSS)*2			
1116 124 NW		##(\$051/\$052)*((EXP(\$052*(\$050)/24)-EXP(\$052*(\$050)/24)/\$550)	-(\$0\$160\$2]*((EXP(\$0\$2*\$62\$0-62\20)-EXP(\$0\$2*\$62\$0-62)[26)[68\$55)	*(10041004)7277.7 *(1004100)7277.7	=(J54790)^Q64 =(J55/100)^Q65	0.012	=(1541.54)*2	• (- 41 (50)		
MF		T/4 =(\$D\$1/\$D\$2]*((EXP(\$D\$2*(\$C\$50)/24)-EXP(\$D\$2*(\$C\$55)/24))/\$B\$55)	=(\$C\$1/\$C\$2](EXP(\$C\$2]\$C\$6C6Z/20-EXP(\$D\$2]\$C\$55-6Z/2/()\$\$\$65)	=(+156+156)*277.7	-(J30/100)*G356	0.006	+(105-L55)*2 +(105-L55)*2		(· ·		=AVERAGE(LS5:LS8)	=(055-R55) *2
w	731386 3636540 1,20		=(\$D\$1/\$D\$2)*((DP(\$D\$2\75C\$80-52)/24)-EXP(\$D\$2\75C\$85-62)/24)\75855) -	=(H57+H57)=277.7	=(3577100)*G57	0,049	=107-157-2					
Ċ		#15 -(3D\$1/8D\$2)*(EXP(3D\$2*(\$C\$3D)/24)-EXP(\$D\$2*(\$C\$35)/24)/\$B\$35)	-(#0\$1450\$2)*((EXP(#032*[\$0\$50-52)/24)-EXP(#032*[\$0\$65-62)/24))#5555)	*(158+156)*277.7	*(J58/100)*G58	0.026	=(1004-100)-5		-402-403-0301-3			
\$W		565-(1011/1012)*((EXP(1012*(10150)/24)-EXP(1012*(10150)/24)/1015)	-(\$D\$1/\$D\$27((DP(\$D\$27\$C\$30-62)/24)-EXP(\$D\$27\$C\$35-62)(24)(\$B\$465)	=(H59+H59)*277.7	=C358/100)*G58	0.008	=(ICSFLEE)*2	. ;		=AVERAGE(KS0:KSS)	-NED LOCA en-	-/000 Deman
•			· · · · · · · · · · · · · · · · · · ·	5	(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	4,440	-(100-00)2	•	-luneanne nasta		=AVERAGE(L59:L63)	400HGB)/2
,		:										